CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Memorandum

TO: MAKING GOVERNMENT WORK BETTER COMMITTEE

FROM: Katy Allen
Randall Murphy

SUBJECT: **GEOGRAPHIC INFORMATION SYSTEM (GIS) PROJECTS**

DATE: November 9, 2006

Approved | Date

At its April 20, 2006 meeting, the Making Government Work Better Committee requested a presentation on Geographic Information System (GIS) accomplishments. The attached report provides detailed information about the City's past and present GIS efforts to supplement the visual overview that will be presented at the November 16th Committee meeting. The report is also intended to serve as a reference guide to the kinds of maps and images made possible by the City's investment in GIS.

BACKGROUND

The first digital maps of San Jose utilized by City staff were derived from a PG&E map that was acquired in the late 1970s. These early Public Works maps showed only public streets and utilities, and while representative of San Jose, were not accurate enough to allow for precise measurements. Since that time, a number of Departments with differing priorities and funding capabilities created their own mapping groups and began capturing their own data, sometimes duplicating efforts on their way to meeting different needs. Departments that pursued GIS capabilities included Public Works (DPW), Planning, Building and Code Enforcement (PBCE), Parks, Recreation and Neighborhood Services (PRNS), Environmental Services (ESD), Airport, Police, Fire, and Information Technology (IT).

Development of the Integrated Development Tracking System (IDTS) and its San Jose Permits Online web interface brought together the technical staff from 4 Departments: PBCE, DPW, Fire, and IT to create a private development permitting system that utilizes maps to retrieve and view data. During this project, discussions were held on data ownership, compatibility and accuracy and a great many inter-operability issues were identified. Different departments were using different software solutions that created compatibility problems – particularly with updates of data captured with different software. Beginning with the development of the IDTS project, the GIS staff in different departments began working together to develop citywide GIS standards.

RECENT DEVELOPMENTS

In September 2005, the Information Technology Planning Board endorsed an Enterprise GIS Strategy for the City of San Jose which calls for the implementation of a centralized GIS infrastructure administered by the IT Department, and leaves data management responsibilities with the line departments that are the primary users. The Strategy includes 1) identifying opportunities and constraints to integrating the various GIS systems operating in the City; 2) establishment of enterprise processes, projects, and standards by a GIS Technical Advisory Committee; and 3) continuing the City's orthophotography and base map spatial adjustment projects.

Internal coordination between City departments and the adoption of a common GIS data model have created a foundation for a number of important GIS achievements including:

- A partnership with the County and Water District to fund high-resolution **orthophotos** of the County that can be used for presentations and as a basis for horizontal adjustments to the City's Base Map
- **"Rubber Sheeting"** (horizontal adjustment) of the base map, sanitary sewer, Municipal Water, and major planning layers allowing overlays that are accurate within 2 feet
- Expansion to a **county-wide base map** which allows for data and updates from outside agencies such as FEMA's flood maps and the Water District creek layers which precludes the need for internal maintenance on those layers
- Upgrade and maintenance of Public Safety's **Computer Aided Dispatch** system
- Enhancement of the City's **streetlight GIS database** and the creation of a website that allows its use by Public Works design staff and Department of Transportation maintenance staff.

In May 2006, Council appropriated funds from the Geographic Information Systems Reserve to purchase the hardware and software to establish a central repository for the City's GIS data. This standardized GIS database provides a platform that can be read by all major GIS software vendors. This allows each Department to use the commercial off-the-shelf GIS software that best meets its business needs while pulling information from and saving data to this repository.

ONGOING CHALLENGES

As the City's GIS has been refined and improved, requests for data have increased. The City has recently supplied GIS data to numerous agencies including FEMA, BART, the Chamber of Commerce, Adult Parole Operations, and the Evergreen School District. The many benefits of data sharing include increased error identification and correction, increased willingness from consultants and developers to submit map changes in digital form, and increased satisfaction with local government among residents and businesses. Staff is exploring ways to implement self-service data dissemination that will allow users to download data themselves and reduce the increasing demand on staff resources for provision of this kind of service.

Funding for GIS efforts over the years has been sporadic, coming primarily from special funding sources (Capital, Development Fees, Airport, ESD) to meet the specific needs of these specially funded programs. Continued funding from these programs is appropriate, but as the City's GIS capability has increased, there are wider demands for GIS services, data, and maps. For many of these goods and services, the cost might more appropriately be borne by other funds. In the coming months, City staff will analyze ongoing GIS-related infrastructure and staff costs and services provided. If appropriate, an alternative funding package may be proposed for Council consideration in the 2007-2008 budget process.

Digital mapping has come a long way since the City obtained the PG&E map in the late 70s. The accumulation of errors on that map meant that a data point could be hundreds of feet from its actual location. The City's new base map is accurate within 2 feet. The visual presentation at the November 16th MGWB Committee meeting will highlight a number of current and future GIS initiatives. In the long term, the development of the City's Geographic Information System capacities will provide the organization with numerous opportunities to work smarter, and has a very real potential to "make government work better" for the residents of San Jose.

COORDINATION

This memo and the attached report have been coordinated with the Airport, Environmental Services, and Planning, Building and Code Enforcement Departments.

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Report on Geographic Information System Projects

Making Government Work Better Committee

November 16, 2006

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INTRODUCTION

What is GIS? The term Geographic Information System (GIS) refers to the technology that links tables of database information to graphical features, such as streets, parcels or pipe lines that may be represented on a map. A hard copy map can provide a better visualization of tabular data by using colors and symbols to represent the database information. A digital map is even more versatile in that it can be linked to a database containing detailed information specific to locations on the map.

This report details the development of GIS in the City of San Jose, recent efforts to integrate the work of various departments, current and ongoing projects, and challenges to enhancing the City's GIS capacities

BACKGROUND

The creation of an accurate and useful GIS requires a great deal of behind the scenes work. Staff identifies data to be acquired, defines database structures and interrelationships, collects and inputs data from many sources, checks the database for errors, provides data to enterprise applications and ensures that it works with those applications. Then, staff collects feedback from users to determine how to make GIS better and more useful. Staff also works with vendors and software developers to identify products that will make operations more efficient and to ensure that City needs are incorporated into the next software versions.

EARLY SAN JOSE GIS

The City of San Jose began its digital mapping program in the late 1970's when it acquired a PG&E map of the City. During the ensuing years, this base map was updated and used to create other maps for many City programs. This included maps representing the City's General Plan, Zoning, master plans and utility infrastructure. While the PG&E map was a good representation of the City, it was not created with modern digital technology. Nearly all of the lines of the map were too short or too long and the accumulated error in these lines caused points on the map to deviate from 50 feet to 800 feet from their true locations.

The early GIS program was established for very limited purposes. Initially, the maps only showed public streets and utilities. The information collected for the early database was very job specific and limited in nature. Over time, departments with conflicting priorities and funding capabilities created their own mapping groups and began capturing their own data, often duplicating the efforts but not the results of other departments. From an enterprise perspective, GIS efforts were haphazard and disjointed.

Development of the Integrated Development Tracking System (IDTS), beginning in 1998, brought together the technical staffs of four departments, Fire, IT, PBCE and Public Works to create a web based private development permitting process that utilized maps to retrieve and view data. During this project, discussions were held on data ownership, data compatibility and data accuracy and many GIS challenges were identified.

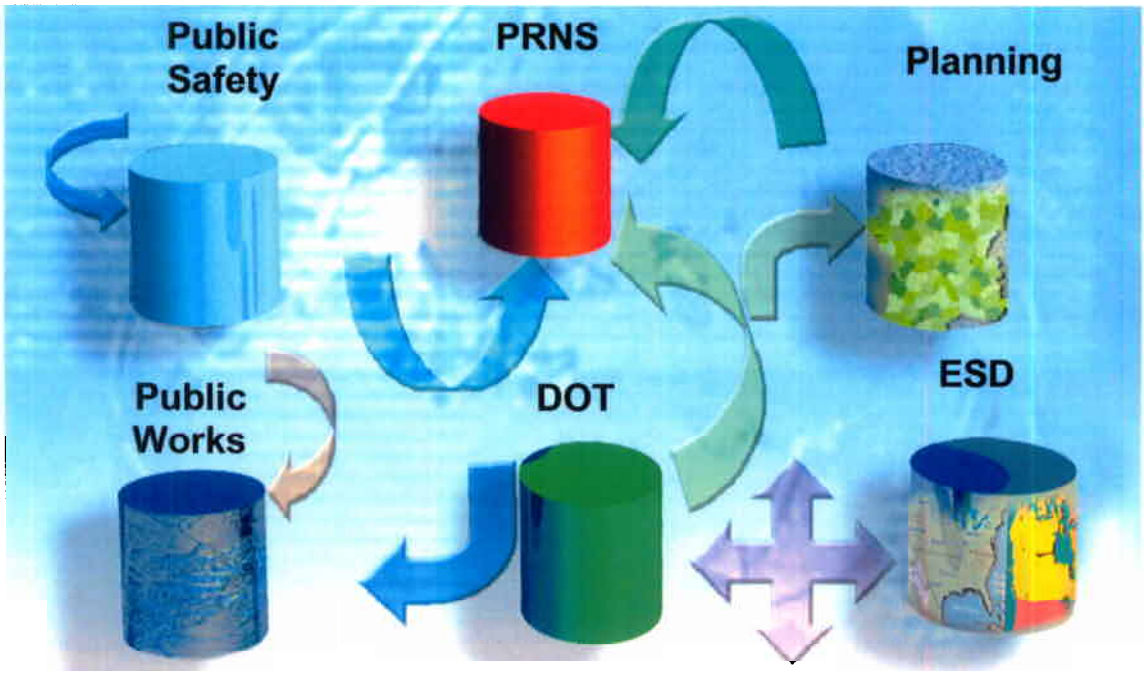

Figure 1: Pre IDTS organization of GIS in silos

VISION

As work on the IDTS project began, Public Works GIS staff realized that a great number of large and small projects would need to be accomplished in order to create a "state of the art" GIS program and so developed a Vision statement to help focus its efforts. Staff's Vision became the "Development of an open, interoperable and efficient data centric system that provides quality data to our user community." By embracing this Vision, staff's focus shifted from a narrow view of departmental projects to a wide angle view of enterprise programs.

- **Open and Interoperable** – To allow better access to data and to increase its usability, staff developed GIS data standards and guidelines for Public Works. They then obtained buy-in from IT and other departments to ensure that the guidelines would conform to interdepartmental needs. Staff also created metadata that met federal standards for the GIS data maintained in Public Works. Metadata is background information on the GIS data explaining when it was created, when it was last updated, who to talk to about the data and so on. Another successful outcome of these early meetings was the sharing of information and ideas to keep the collective program on track.

- **Efficient** – To become more efficient, staff created a data model for Public Works related applications with input from IT and other departments that might find the data useful. A data model helps to define user needs, both current and future, defines where the data is coming from and where it is going, and simplifies the data update process for programs using enterprise data. During these discussions, when staff said "It would be helpful if we had ….",

placeholders were inserted into the data tables until such time as that information could be acquired. As staff works with consultants on master planning and other studies, data that will be helpful in conducting future business is often identified. If consultants acquire new information during the course of these contracts, staff saves that information by populating new data fields.

Efficiency was also improved by identifying various potential data sources and determining where ownership should reside. As an example, PBCE maintained a list of approved street names. Public Safety also maintained a list of street names that its dispatchers used and was considering the purchase of privately compiled data for $10,000. Public Works maintained a list of mostly public streets that were included on its base map. After comparing the lists and resolving differences, Public Works now maintains a commonly used public and private street name database along with a list of any alternate spellings. The database also includes street names in nearby areas subject to mutual aid.

- **Quality Data** – To provide better data, staff improved its horizontal accuracy, improved error reporting and identified the source of process related errors. The rubber sheeting project has improved the horizontal accuracy of the City's base map from a variance range of 50 feet to 800 feet in any direction to accuracy within two feet. Most PBCE and utility map layers, except the storm and street light layers, now overlay this more accurate base map.

  Error reporting websites have been created to allow GIS data users to report data problems and to allow GIS staff to provide feedback when corrections have been made. A website was created specifically for use by Public Safety's CAD dispatchers during the recent deployment of their mobile mapping software. Confirmation that staff has corrected reported errors has gone a long way in increasing user confidence in the maps.

  When staff determined that a source of errors was related to the data input process, the data model was used to create triggers, constraints and drop down menus to minimize these errors. Triggers automatically populate certain fields and remind staff to populate additional information fields. A constraint prohibits staff from populating a field with erroneous data. For example, a 2" valve can't connect two – 12" pipe segments. And, drop down menus reduce typing and typographical errors and speed up data input. When data from a specific process is not input, staff is reminded to forward on a regular basis any changes impacting the maps and GIS database. Forwarding change information must become an integral part of all work flows, as failure to do so can create recurring problems for activities that occur less frequently, especially with the inevitability of staff turnover.

  Programs throughout the City are using a wide variety of GIS tools. Any effort to standardize on a specific GIS product would require a great deal of time as well as investments in additional software licenses and training for staff. As a more productive alternative, staff is supporting a data-centric GIS environment that focuses on a standardized GIS database. This standard database uses Oracle Spatial software, which is now installed on the City's enterprise GIS servers. All major GIS software vendors can read directly from an Oracle database, which allows staff to use the best commercial off-the-shelf (COTS) product

for their program. In addition, Oracle provides the best response times for large data sets and has the best available security for our GIS data.

- **Departmental Collaboration** – In addition to interdepartmental collaboration on the data model and large projects like CAD and IDTS, staff has formed a GIS Standards Committee and a GIS Technical Advisory Committee to support the Information Technology Planning Board (ITPB). Along with work on standards and ITPB related issues, staff is encouraged to share information on their current projects and upcoming proposals and to provide any input that may add value to other departments' projects.

USER COMMUNITY

The original user community was limited to a few departmental applications that needed maps. Developments over time have expanded the need for GIS data. Major factors that changed the role of GIS include:

- Computer technology - improvements in hardware, esp. graphics
- Database Technology
- Development of theories of spatial processes in economic and social geography, anthropology, regional science
- Increasing social awareness, education levels and mobility, awareness of environmental and safety challenges
-

The bottom line is that 50% of the data now in use by government is SPATIAL!

Figure 2: Examples of how GIS is used in San Jose today

The City's user community is primarily internal GIS enterprise applications and other governmental agencies interested in data sharing. Staff has worked with the County, Water District and local cities to develop the countywide orthophoto program, the LiDAR / contour layers and the regional base map. In addition, staff has recently provided GIS information to:

- FEMA to support its DFIRM update project. In the future, after final delivery, LiDAR / contour data will be provided as well.
- BART for consultant studies along the proposed route through San Jose.
- San Jose Chamber of Commerce for making maps of downtown ....
- The Brake Pad Partnership for estimates of the amount of copper deposited on local roads.
- Adult Parole Operations to comply with California State Assembly Bill 113
- County Sherriff's Office for Crime Scene Investigation
- Evergreen School District for school bus routing
- Consultants working on City projects.

The City realizes benefit from data sharing. A regional map increases everyone's ability to share data because graphics match and agencies can import data files without a need to redraw them. There is greater opportunity for errors to be discovered, reported and corrected with more eyes on the data, so data quality and reliability are enhanced. There is greater buy-in from consultants and developers who are asked to submit map changes in a digital form that simplifies staff data input efforts. And finally, there is greater citizen / business satisfaction with local government because they realize a direct benefit from their tax dollars.

Staff also supports requests for data from external, non-governmental agencies. However, this support is very limited due to the demands of on-going projects and limited available resources.

COMPLETED PROJECTS

1. Internal Coordination Project – A number of formal and informal groups have met to discuss GIS database definitions, guidelines and standards. The end result of their activity is a GIS program that focuses on data rather than software and data that can be used effectively throughout the City.

Outcome/Who Benefits: Staff that agreed upon the guidelines and standards for an open and interoperable GIS program. All staff that use GIS data have benefited from GIS staff participation in these meetings.

2. Data Model – The Foundation – Staff from many departments and programs met to discuss their data needs. Data tables and data structure standards were defined along with triggers, constraints and drop downs as well as data ownership and interrelationship.

Outcome/Who Benefits: The creation of an efficient and effective database adopted by other departments making it a City-wide effort. All staff and programs that participated in the discussions benefit because their data needs are now reflected within the GIS data model.

3. Orthophotos / Satellite Images – The City, County and Water District entered a cooperation agreement to provide high resolution orthophotos of the county. Additional partners, who were willing to contribute towards this effort, joined the regional effort after delivery of the orthophotos. A website was created to provide intranet access to these 2001 orthophotos and lower resolution 2003 and 2005 satellite images. The orthophoto website can be viewed at: http://pw.csj.gov/gis/e-ortho/ High resolution orthophotos provide very good detail for quick verification of a site's physical condition and facilities. Lower resolution satellite images provide an inexpensive update of the image library for reference purposes. Commercial satellite photography will get incrementally better with the scheduled launch of new satellites, but will not attain the high resolution of orthophotos for many years yet.

Outcome/Who Benefits: A high resolution set of orthophotos that can be used for planning, design, presentations and emergency response activities, as well as serve as the basis for horizontally adjusting the City base map. Orthophotos are used by staff as a ready reference tool when speaking with customers and clients and in lieu of time consuming trips out of the office. They are used for presentations and as background for plans, exhibits and submittals. Specific examples of uses include attorney's exhibits, site selection and property acquisition and council presentations. They are also used by Public Safety and emergency response staff.

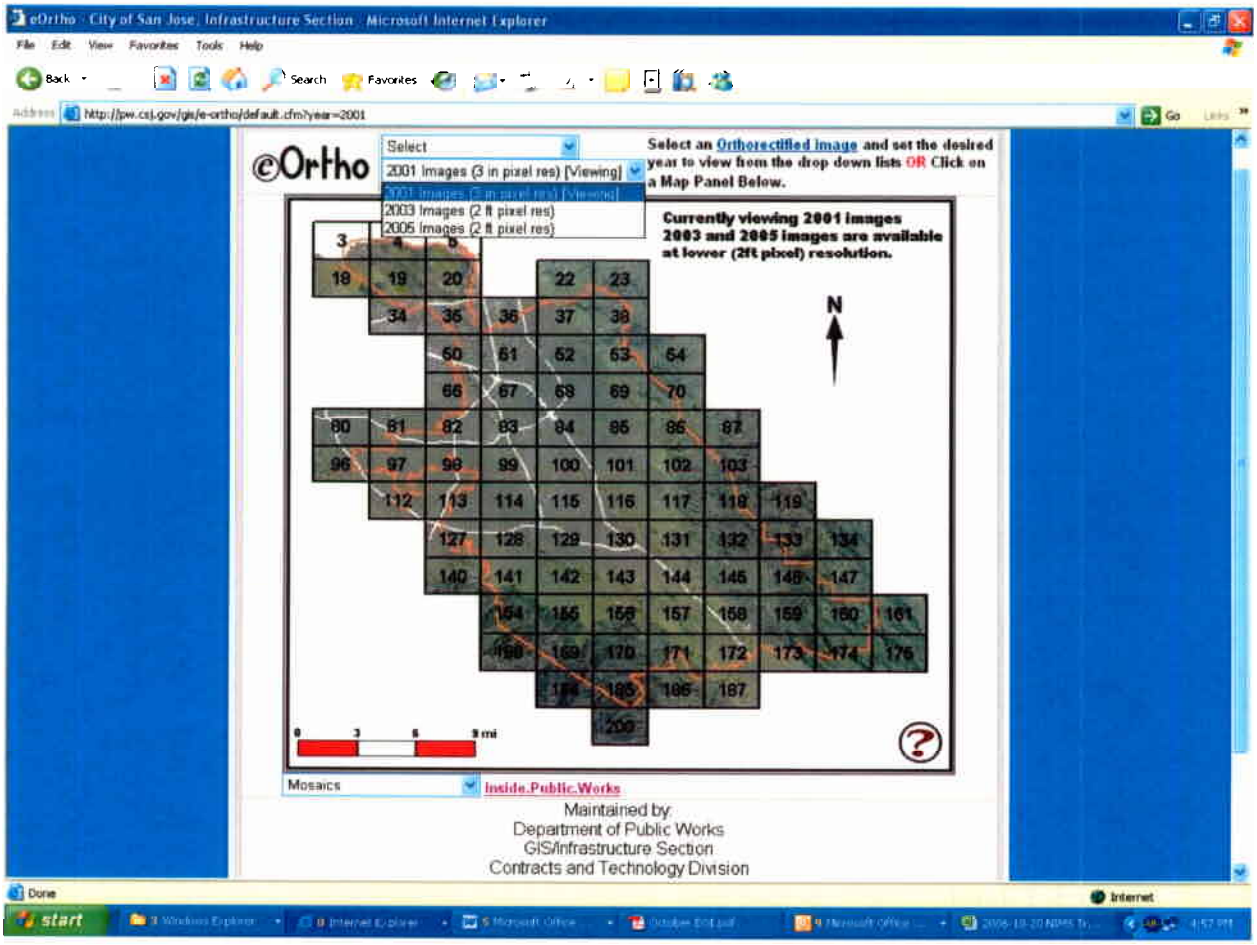

Figure 3: View of the eOrtho intranet page

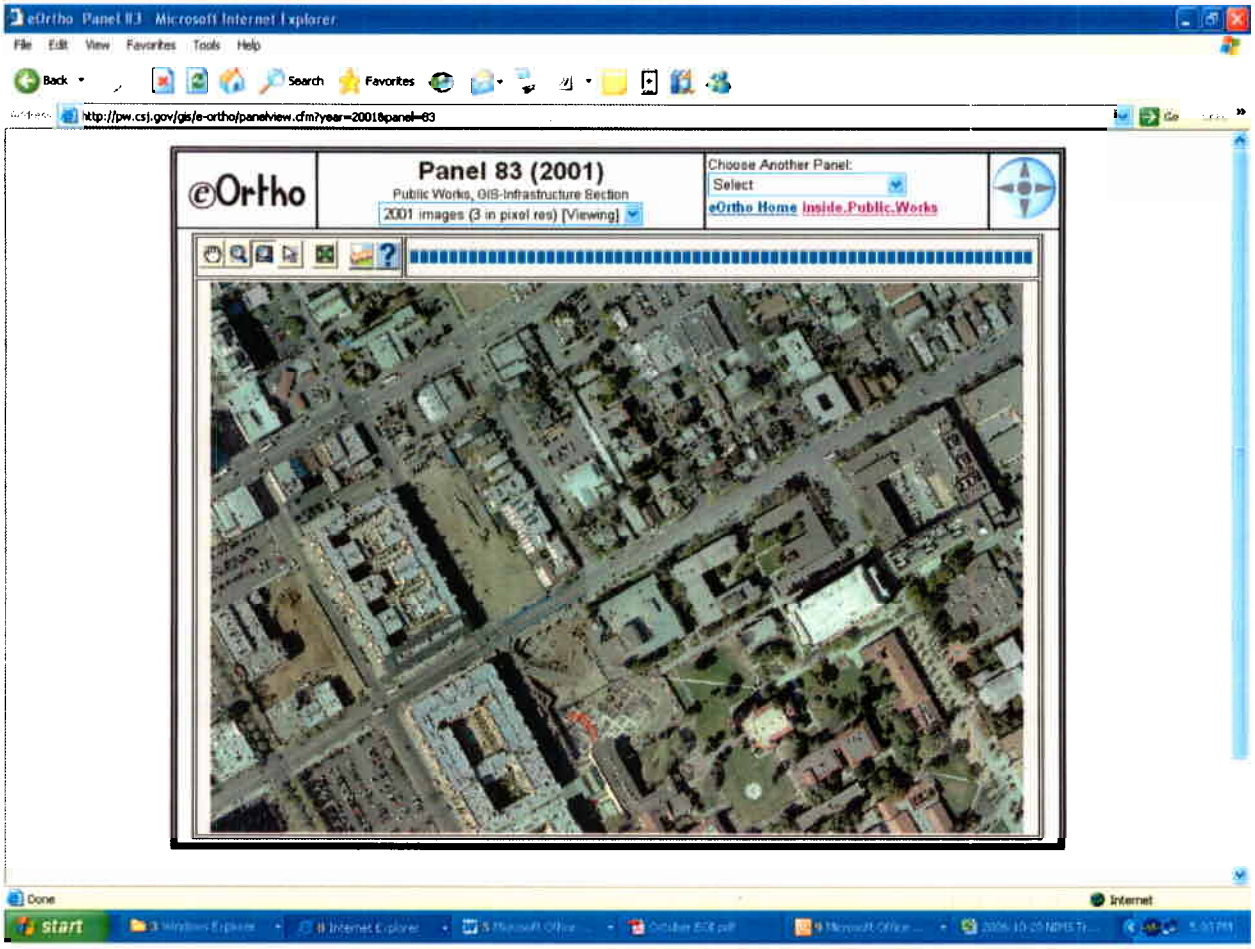

Figure 4: 2001 orthophoto view of the New City Hall / MLK Library sites

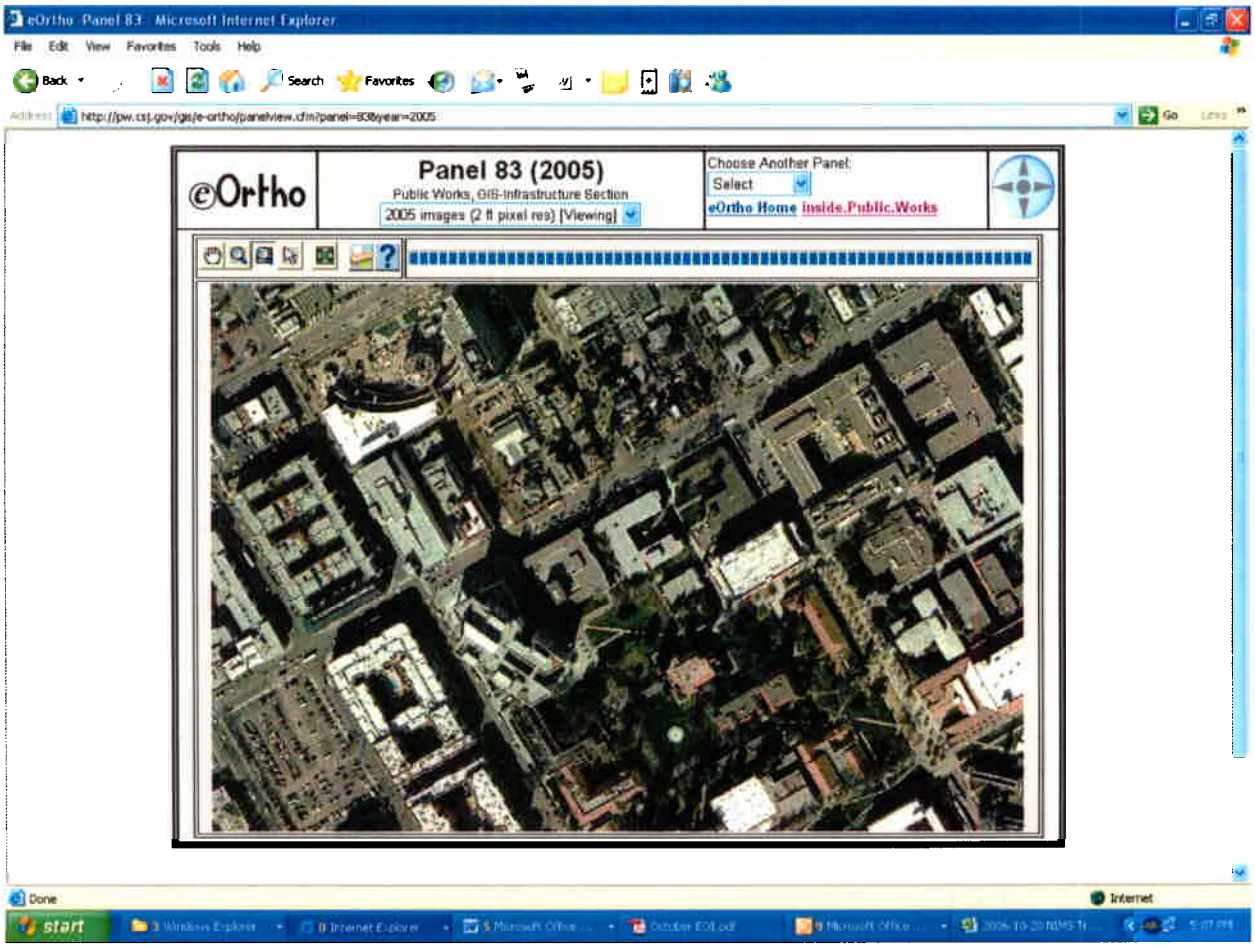

Figure 5: 2005 satellite image view of the New City Hall and MLK Library sites

4. Rubber Sheeting – Rubber Sheeting is the horizontal adjustment of GIS graphics to a specified accuracy. City of San Jose maps were known to be mislocated by as much as 800 feet in areas furthest from downtown. Some properties and facilities on the map were shortened or lengthened in a disproportionate manner because the original PG&E map had accumulated errors that created a space that was either too small or too big. The base map, sanitary sewer layer, major planning layers, and Municipal Water layers were adjusted. The storm sewer layer and streetlight layers have not been adjusted.

Outcome/Who Benefits: A base map and GIS data layers that are accurate within two feet of their actual location and overlays on the orthophoto with no visible offset. Everyone who uses GIS benefits by having more accurate maps. For example, Public Safety is able to track vehicles on maps using Automated Vehicle Location (AVL) technology – vehicles follow streets and don't wander across private property or through buildings because the maps are accurate representations of the real world. GIS data for areas can be used to better calculate fees. Accurate GIS data can be used in flow models as it better reflects pipe lengths and elevations.

5. Regional Base Map – During preliminary discussions for the orthophoto cooperation agreement, staffs from the City, County, Water District and many other local agencies began discussing the potential for creating a regional base map. The City's approval of a contract to adjust its existing base map, including all parcels within the City sphere of influence, to a horizontal accuracy of two feet was a catalyst for this regional effort. With slightly more than fifty percent of the parcels within Santa Clara County being adjusted under City contract and with a commitment from the Water District and other local agencies to supplement funding the adjustment of the remaining parcels, the County agreed to create a countywide base map. A City / County data sharing agreement was executed in July 2005 and the inaugural version of the countywide base map was released on September 27, 2005.

Outcome/Who Benefits: A countywide basemap that is updated every three months at a minimum. A regional map is beneficial because staff will be able to use map information for streets and parcels adjacent to the city limits for activities such as planning notifications, airport noise and sanitary sewer studies, mutual aid (CAD), and so on. Staff can obtain data and updates from outside agencies, such as FEMA flood maps and Water District creek layers without a need for internal maintenance on those map layers.

6. CAD Phase I – Public Safety's Computer Aided Dispatch system was upgraded and now operates with street centerline maps and other GIS data maintained by staff. On average, CAD dispatchers have reported finding fewer than 4 map errors for every 10,000 times that they access the GIS maps in response to an emergency call. Map updates, including error corrections and modifications from new development, are posted to the system every one to two months.

Outcome/Who Benefits: Public Safety staff use of enterprise GIS base map layers and address database for dispatch purposes. Public Safety staff and the general public benefit from GIS data that is more reliable, efficiently maintained and updated on a regular basis. Enterprise GIS data has more staff using it and reporting on errors, so the overall quality of the data is better.

7. South Bay Water Recycling Program – This infrastructure mapping project created a coherent system to monitor and track the location, and conditions, of reclaimed water utility infrastructure within the City. Environmental Services staff used Global Positioning System and Geographic Information System Technology to map the locations, and document the existing conditions, of reclaimed water infrastructure (valves, meters, pipes, etc…). The project was completed during September 2006.

Outcome/Who Benefits: An accurate and complete recycled water data set and map books have been created. And, as a result of this project's success and the resulting cost savings, the methods associated with this project have been adopted by other divisions within the Environmental Services Department, including the City's Municipal Water System and the San Jose-Santa Clara Water Pollution Control Plant. Maintenance and operations staff have better tools to find and repair facility problems. All meter and customer locations were identified and permitted according to the State of California Department of Health Services. Customers connected to the system can be notified of service interruptions in a matter of minutes; previously it took several days to notify customers. The Cities of Santa Clara and Milpitas also benefit.

8. Infrastructure Management Systems / Traffic Operation System – Streetlights – Staff recently completed enhancements to the streetlight GIS database that simplify data entry and retrieval and automatically create a street light connection order for PG&E.

Outcome/Who Benefits: The creation of a web site to input streetlight data that can be used by DPW design staff and DOT maintenance staff. Maintenance crews and design staff benefit by having data and system maps readily at hand.

CURRENT PROJECTS

1. Integrated Development Tracking System (IDTS) – The private development IDTS application uses GIS maps to help locate property, track documents and query the enterprise database for information about properties within San Jose. The application uses older versions of software and maps. Most maps utilized by this application have been superseded by horizontally adjusted maps and are no longer updated.

Outcome/Who Benefits: An upgrade to the software and maps used in the system and a simplified, automated data update process. A follow-up contract for additional enhancements to web enable the map display is being considered. This work benefits staff and the development community by ensuring that up-to-date data about properties is available on-line in an easy to use application. Direct web access will eliminate the need for periodic software installations and upgrades on individual desktops.

2. Orthophotographs – The City, County and Water District entered a cooperation agreement to provide high resolution orthophotos of the county in 2001. Staffs from each agency have come to rely on these tools for conducting day to day business. After five years, staffs needed newer orthophotos of the same high accuracy. A contract for high resolution orthophoto updates was awarded by the County. This contract is funded by local agency contributions and supplemented with a federal grant.

Outcome/Who Benefits: Orthophoto updates that are available on the City eOrtho website by April 2007. Staff from many departments and programs benefit by having up-to-date orthophotos readily available for reference.

3. Regional Base Map – Although updates are scheduled for every three months at a minimum, regional basemap updates are pending efforts to simplify the data sharing and update process. City and County are working together to utilize existing off-the-shelf software to make the basemap update process more efficient.

Outcome/Who Benefits: A simplification of the regional map update process. County will have a much simpler data update process and City will have a regional map file in a format that is available to all map users.

4. Contours – Using funds from the sale of orthophotos to Additional Partners and a supplemental contribution from the Water District, the City, County and Water District entered into a cooperation agreement to acquire countywide contour and elevation data using airborne LiDAR technology. This technology measures the amount of time that it takes for a beam of light from an airplane to bounce off the ground and return to the airplane. It also measures the intensity of the returning light beam to help determine if the beam hit a hard surface, vegetation, bare earth or water.

Outcome/Who Benefits: Data from this effort will provide one foot contours of the valley floor and five foot contours in the hills. Contour data for the entire county is expected to be available by April 2007. It will also identify the top of creek banks and provide a graphical layer of building rooflines. Elevation data will support conceptual planning, preliminary engineering and emergency response projects.

Samples of the contour data from North San Jose are shown below:

Figure 6: 2006 contours and top of bank near I-880 at Dixon Landing Road

Figure 7: 2006 contours, top of bank and building rooflines at McCarthy Ranch

5. Google Earth/Google SketchUp 3D Visualization – This GIS-related project involves early experimentation with Google products (Google Earth and Google SketchUp) to create three-dimensional visualizations that incorporate use of Planning data. Planning staff have:

- created a website of transit-oriented "smart growth" housing projects in San Jose (http://www.sanjoseca.gov/planning/smartgrowth/tod_map.asp);
- Imported CAD drawings of downtown buildings into Google SketchUp for 3D rendering within Google Earth. A similar process is underway using CAD data from private parties in connection with various development proposals in North San Jose; and,
- Imported Planning GIS data into Google Earth for a brief video illustrating the relationship between existing land uses/topography and General Plan designations. While still in draft form, these videos are anticipated for use at the next City Council meeting on November 14, 2006 (in reference to an appeal of the Planning Director's decision to deny a Tentative Map permit, T06-051, item 11.2) and for upcoming study sessions of the City Council to discuss the guiding principles/major strategies of the General Plan.

Outcome/Who Benefits: A better tool for presentations and decision making. Planners, designers, managers and policy makers benefit from having a better visual picture of existing and proposed conditions (see illustration on cover of this Report).

6. Map Books – The City base map and maps of sanitary sewer, storm drain and Municipal Water facilities are available on an intranet and internet eMap web site. Access to water facility maps is restricted due to security concerns. Staff has been working on enhancements to the website that simplify the map update process and expand map printing capabilities using the Adobe file format. This format also provides search capabilities that make it easier to locate features on the maps. The eMap website can be viewed at: https://cpms.sanjoseca.gov/emap/

While color maps provide good visual representations, traditional black and white maps will also be provided because they are cheaper to mass produce.

Outcome/Who Benefits: Staff will create a website that allows a user to easily print a page or entire map book made up of personally selected map layers. These map books are used extensively by field crews for reference and by non-GIS professionals who need a quick map source for meetings and presentations.

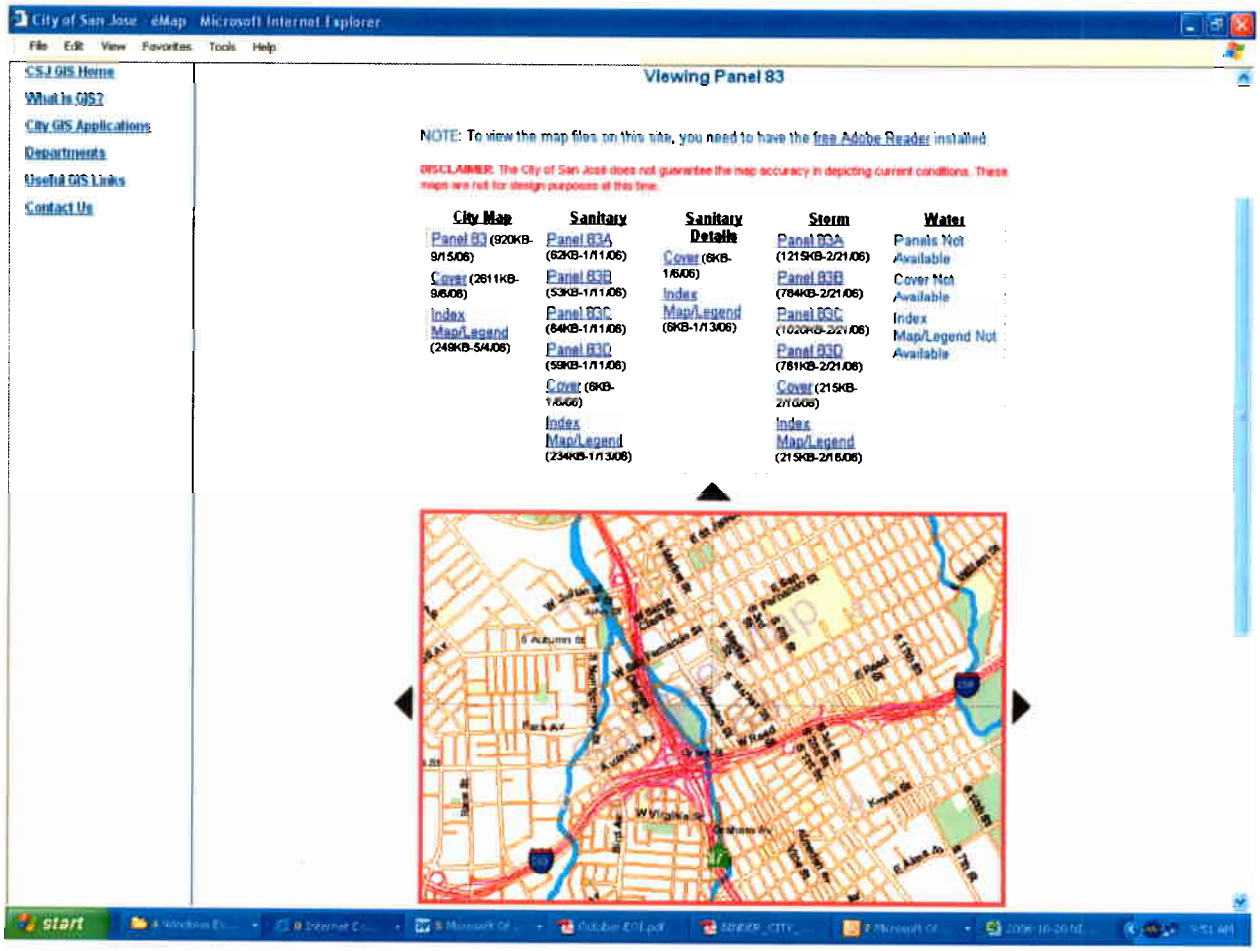

Fig 8: eMap panel page 83 view of downtown San Jose at 280 / 87 intersection

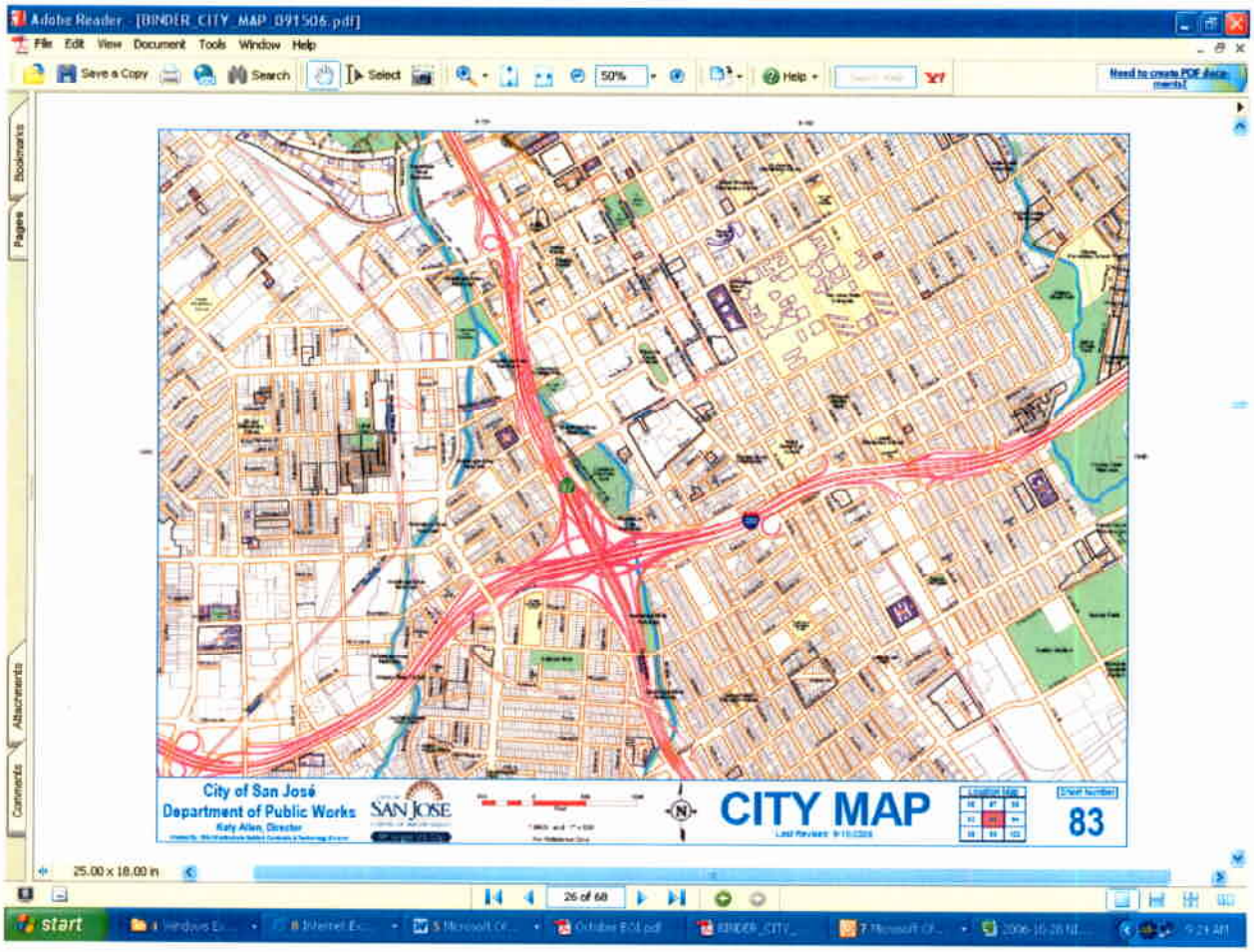

Fig 9: eMap panel page 83 Base Map in Adobe format

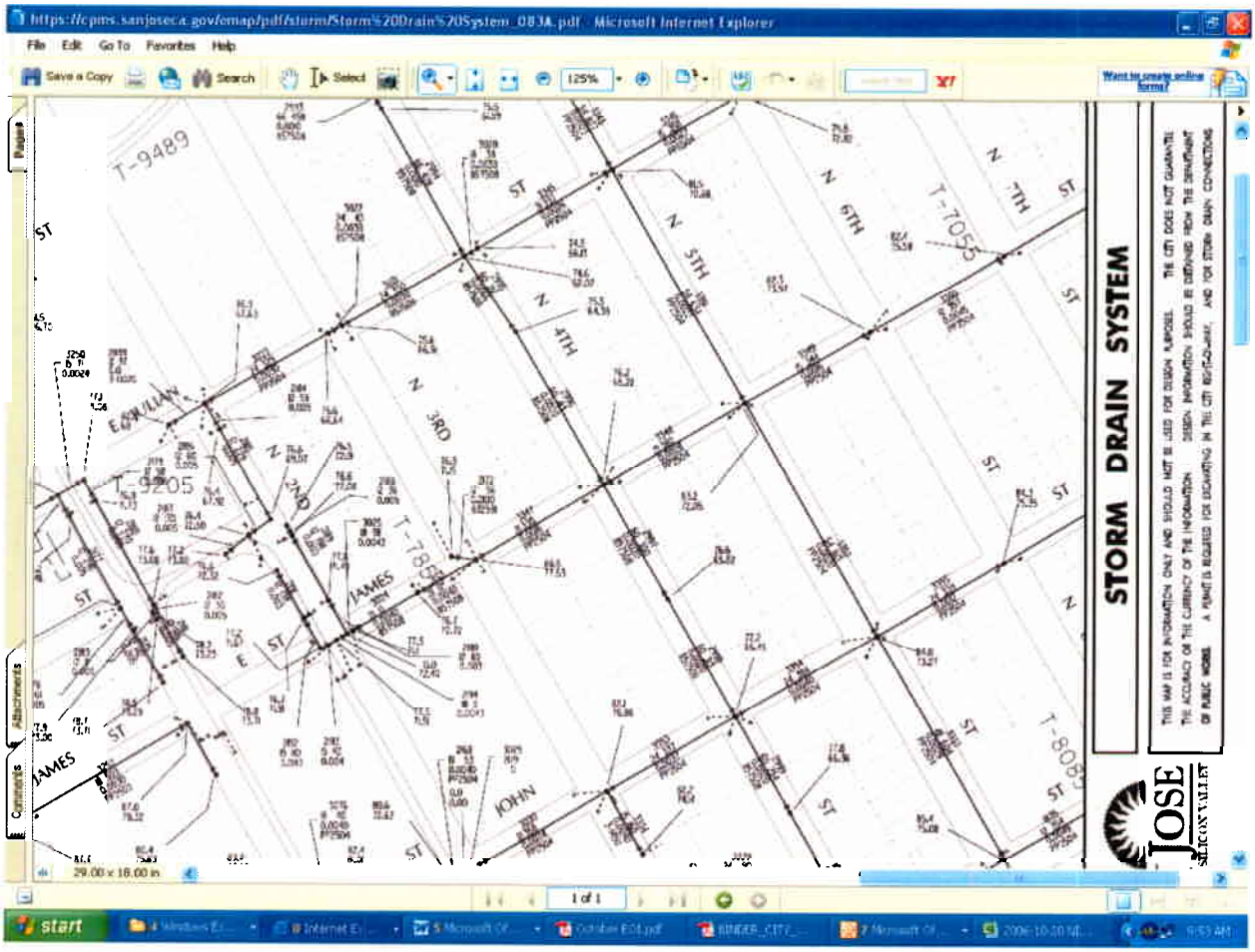

Fig 10: eMap panel page 83 Storm Drain facilities map

7. Capital Project Management System – The Capital Project Management System (CPMS) provides users with information about the City's Capital Improvement Program projects. The CPMS GIS interface is being upgraded. The website can be viewed at: http://apps.sanjoseca.gov/cipmaps/

Outcome/Who Benefits: There will be new search and filter functions for locating projects enabling project managers to graphically locate their projects and easily add them to the website as soon as each new project is authorized and work begins. A map based web site provides an alternative that may be easier to use for locating projects when the user is unfamiliar with project names, but wants to know about the projects in the neighborhood or when they know about a project, but don't know where it may be located.

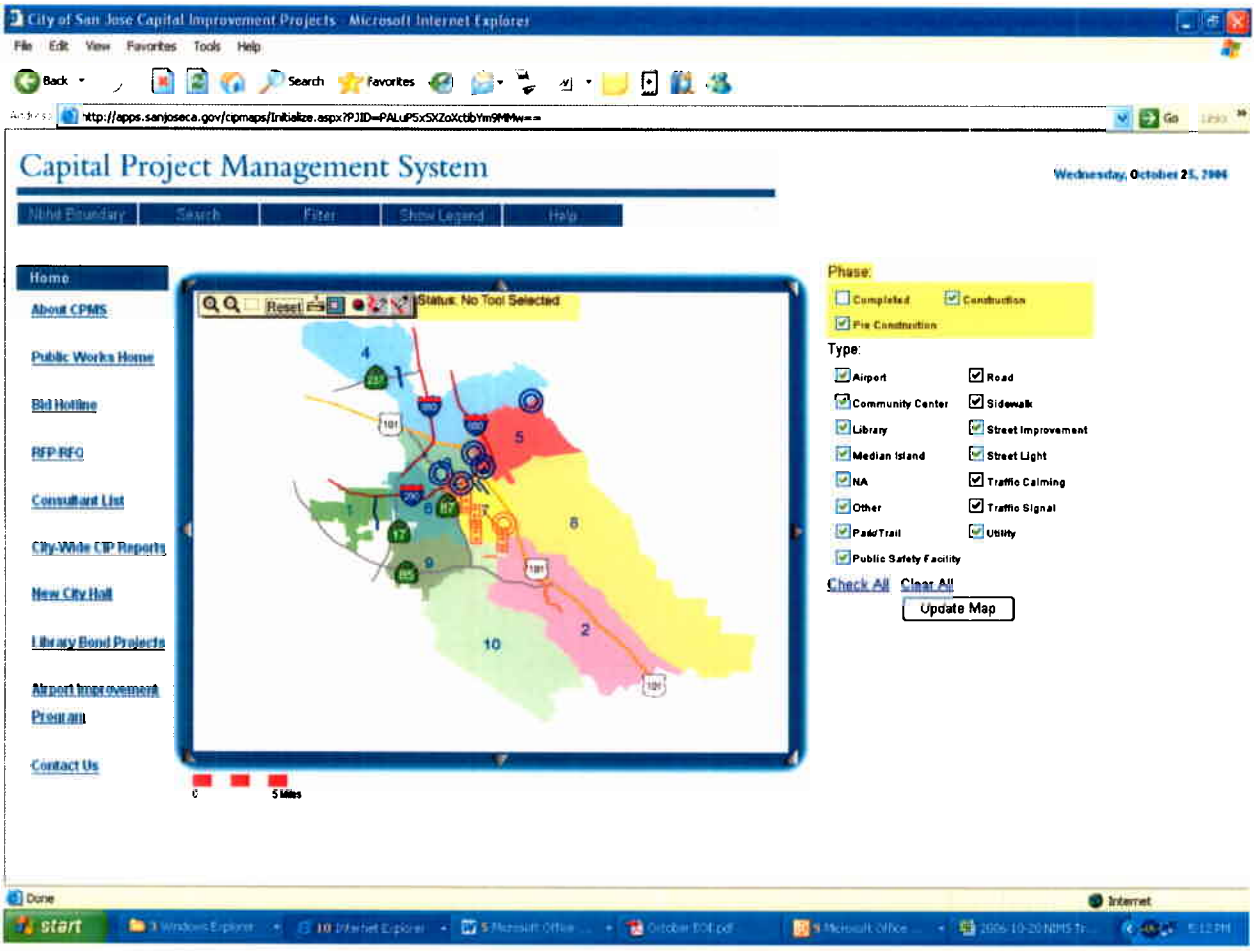

Figure 11: View of the capital project management system's GIS search page

8. CAD Phase II – A Public Safety Computer Aided Dispatch (CAD) system upgrade is planned for early 2007. It will provide more flexibility and enhancements to the overall system. Significant effort will be needed to add the GIS parcel layer, address points and orthophotos to the system. These additions will give dispatchers an alternative means to pinpoint the location of incoming emergency calls and increase their accuracy when they dispatch response teams for the call.

Outcome/Who Benefits: A CAD system that is maintained with the latest versions of software and GIS mapping tools. Public Safety staff will have better tools to locate incoming calls and respond to emergencies. The public will see emergency response teams with a better understanding of the immediate area when they arrive on scene.

9. Enterprise Servers – In an effort to optimize access to and the security of enterprise GIS data, servers have been acquired to host GIS related software, store GIS data in an Oracle Spatial format, edit data in a secure environment, and retrieve up-to-date GIS data when needed. These servers are maintained by IT staff in the New City Hall network operations center where data is backed up on a regular basis.

Outcome/Who Benefits: Heighten staff perception of GIS data as an enterprise asset to be freely shared and increase the accessibility and security of the data. Every user of the data benefits by having better access to the latest GIS data.

10. Interactive Maps – An interactive maps page is being developed to provide staff with a GIS interface. A user can select GIS layers for viewing and zoom to an appropriate level of detail. If the user zooms to a scale larger than 1:250, the orthophoto will appear in the background. If interested in a particular feature on the map, the user can click on that feature and view details about it. For example, if a street centerline is selected, a box opens with information that includes street name, segment ID number, street width, street general plan designation, public or private status, and so on. If a sewer segment is selected, a box opens with information on sewer segment ID number, pipe diameter, pipe material, and so on. Future plans for the site would include access to construction drawings and manufacturer's details for items shown on these maps. An early version of the website is shown below.

Outcome/Who Benefits: An easy to use intranet web site for viewing GIS maps and data. All City staff has access to GIS data regardless of their proficiency with GIS software.

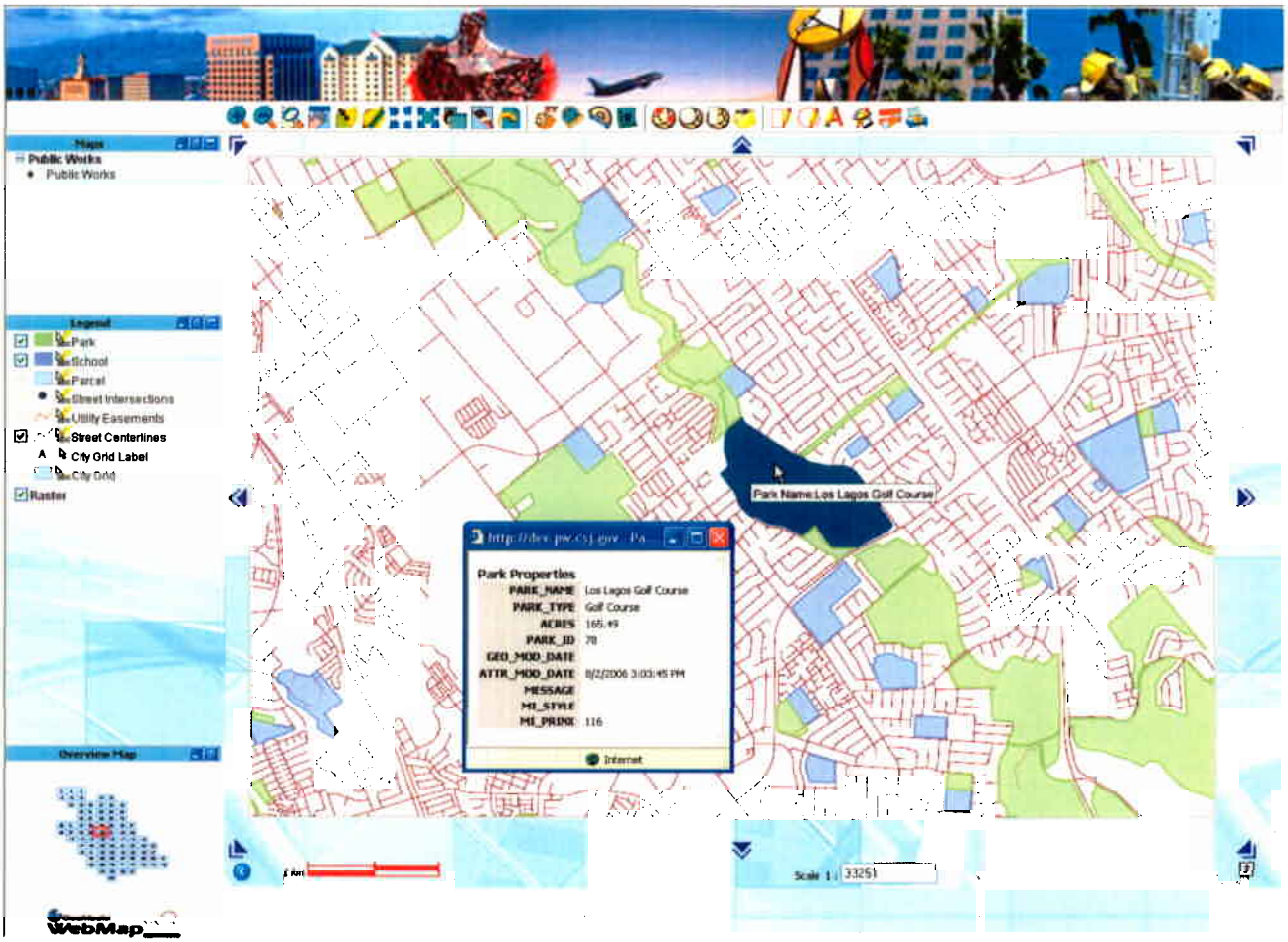

Figure 12: View of the Interactive Maps web site

11. Flow Models / Master Plans – GIS data from the sanitary sewer, storm drain and municipal water facility databases have been provided to staff or consultants for their use in creating master plans and flow models of these facilities. Data corrections have been made when the consultants report missing or erroneous data and data is added when the consultant identifies new features that are required for the flow models. The GIS data files provide a central source for up-to-date information that can be used to evaluate development proposals and eliminate any need for duplicate maintenance of data.

Outcome/Who Benefits: Consultants and staff use GIS data to create master plans and flow models. Information that is not in the GIS database, but needed for the work can be added for future reference. Reports on missing or erroneous data will be used to correct the database, resulting in more complete and accurate data files for staff's future reference.

12. City Owned Property – Staff from Public Works and IT have begun an effort to update and enhance a GIS based website that was created in 2000 to access data about city owned and leased properties. The proposed site will provide links to property related documents, such as title reports, appraisals, and photos. The website may also contain links to information about facilities located on the property, including site manager contact information, environmental documents and facility construction drawings that could be used for reference or for emergency purposes.

Outcome/Who Benefits: An easy to use web site that provides staff with a comprehensive source of data about all City owned property. Real property staff and staff interested in City owned property have a web site for locating properties and related information.

13. Global Positioning Systems (GPS) – Staff from ESD is using GPS equipment to better locate potable and recycled water facilities for GIS maps.

Outcome/Who Benefits: Better locations of city facilities. Having a good location of water meters, valves and other buried facilities makes operations, routine maintenance, nearby construction and emergency response activities more efficient.

FUTURE PROJECTS

1. Infrastructure Management Systems / GIS Integration – Sanitary Sewers – Staff has completed preliminary efforts to integrate GIS maps directly with the Hanson software used for the Sanitary Sewer Management System. This includes minimizing data input backlogs, addressing all error reports, incorporating all data from the master plan / flow model consultants and ensuring that the GIS data structure is compatible with Hanson software. The actual integration will occur when staff or consultant resources become available.

Outcome/Who Benefits: A sanitary sewer maintenance system that utilizes maps to depict service history and outstanding maintenance needs and to plan crew activities. When GIS is integrated with the Infrastructure Management Systems, maintenance and engineering staffs will

be better able to visualize patterns related to reported problems and to dispatch maintenance crews in the most efficient and beneficial manner.

2. Infrastructure Management Systems / New Data Layers - Street Trees – In an effort to support the Street Tree Management System, GIS staff has identified the need for a street tree data layer. Cost estimates for a complete street tree database with graphics have exceeded one million dollars. A more austere effort is proposed to identify the data that staff needs for street tree work related processes and to create a graphical point with an identification number for each street tree in San Jose. Data might include items such as the tree species, health, trunk diameter, proximity of utility lines to the canopy and date that it was last trimmed. At a future date, as tree maintenance crews work on each tree, data about that tree can be collected and entered into the database. The initial effort is estimated to cost less than one hundred thousand dollars. Efforts will be coordinated with tree maintenance staff and planning permit staff. City staff will also contact Our City Forest to ensure that these GIS efforts are compatible with any progress that they have made with GIS.

Outcome/Who Benefits: A street tree database and graphic layer that can be used with the street tree maintenance system. Planners, maintenance crews and environmental programs will have a database that identifies each street tree within the City of San Jose.

3. WIFI And Mobile Devices – Staff is monitoring efforts to create a South Bay WIFI network and to deploy mobile technology to city staff. As mobile technology is deployed and resources become available, GIS staff will support these mapping and database needs.

Outcome/Who Benefits: GIS maps for the City of San Jose that can be deployed using mobile technology. City staff, residents and those doing business within the City limits will have access to City maps and database information.

GIS ENHANCEMENT ISSUES

DATA DISSEMINATION

A website, similar to that created for the State of Arkansas (http://www.geostor.arkansas.gov/Portal/index.jsp) would be helpful in disseminating GIS data to users and has been proposed for implementation pending identification of funding sources. A visitor to the proposed website would identify an area of interest and download available GIS files for that area. If developed as proposed, the site would be free and easy to use, contain regularly updated data and require no interaction with staff. In return for this free data, users would be asked to report any errors in the data that they discover and to acknowledge the City's contribution of data in any published document that uses the GIS data.

This website, when completed, will become the main source of City GIS data and will be used by many public and private entities. San Jose residents, businesses and visitors will benefit from high accuracy maps, orthophotos and other GIS data. City government will benefit when data users acknowledge that good maps and data are being produced and shared by their governing

agency and by feedback on the quality of the maps. Staff will benefit if data requests are automatically filled with little or no need for staff interaction with the requestors of data.

Examples of companies that have requested map data in the past and would benefit from this website include Underground Service Alert (USA) North and map producers Rand-McNally / Thomas Brothers, CSAA, and Barclay's Maps.

ERROR REPORTING

In order to track the status of GIS mapping errors reported by Public Safety dispatchers, staff created a website that notes the error, the action taken to correct the error and the acceptability of the corrective action to the person who reported the error. This has helped to maintain the GIS street centerline data better than 99.96% error free. The website has led to increased Public Safety staff confidence in the reliability and accuracy of the map data. Website access is restricted to authorized Public Safety and Public Works staff only. A view of the site is included below.

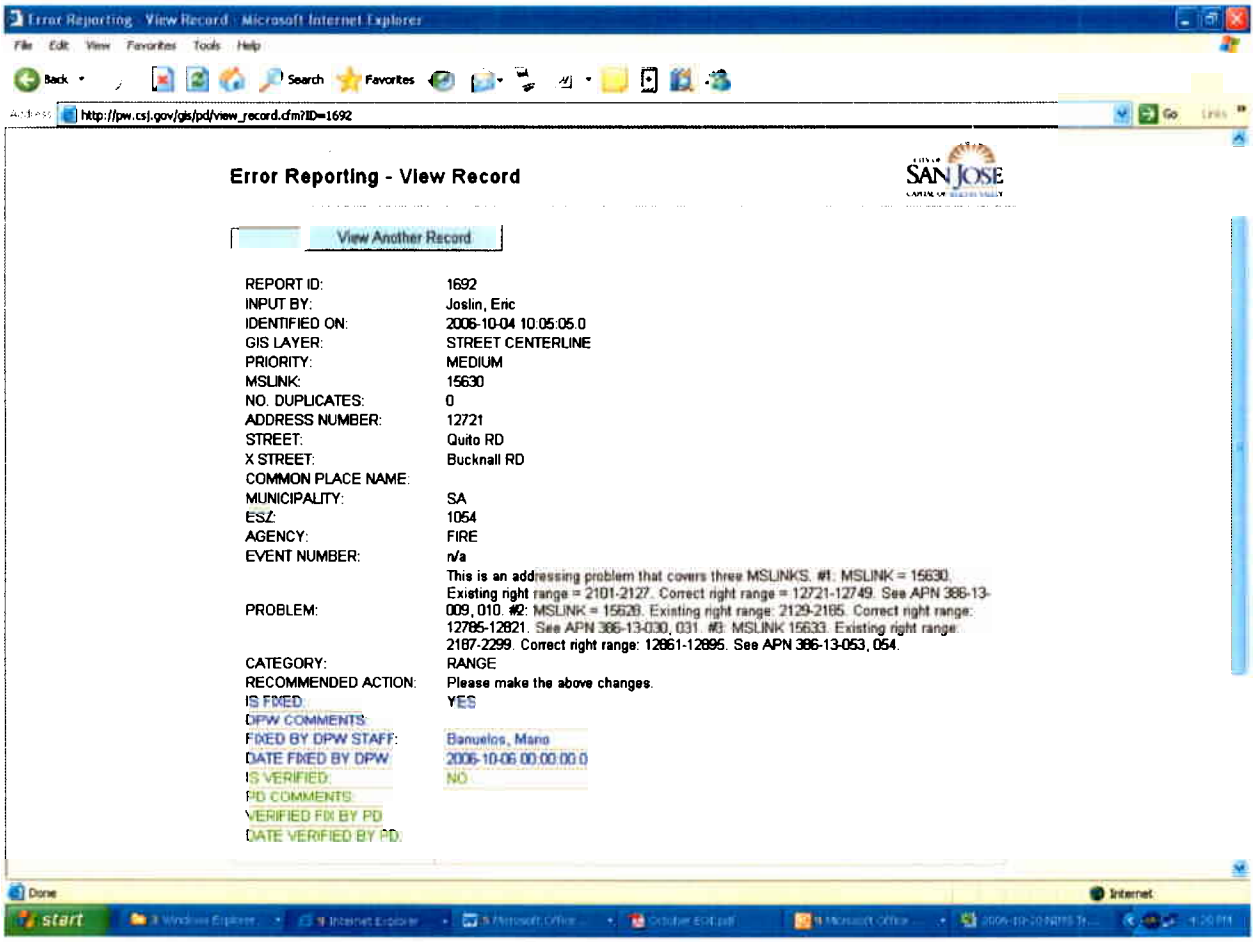

Figure 13: View of the CAD Error Reporting website

Considering the success of the Public Safety error reporting site, an internet website has been created to track errors related to all Public Works maintained GIS data layers. Although not extensively used to date, error reports originating from this site may pick-up when GIS data becomes more accessible to the general public. With more eyes on the data, this process should also reduce the number of map errors discovered by Public Safety dispatchers. This website can be viewed at: https://secure.sanjoseca.gov/gis/gis_err.asp

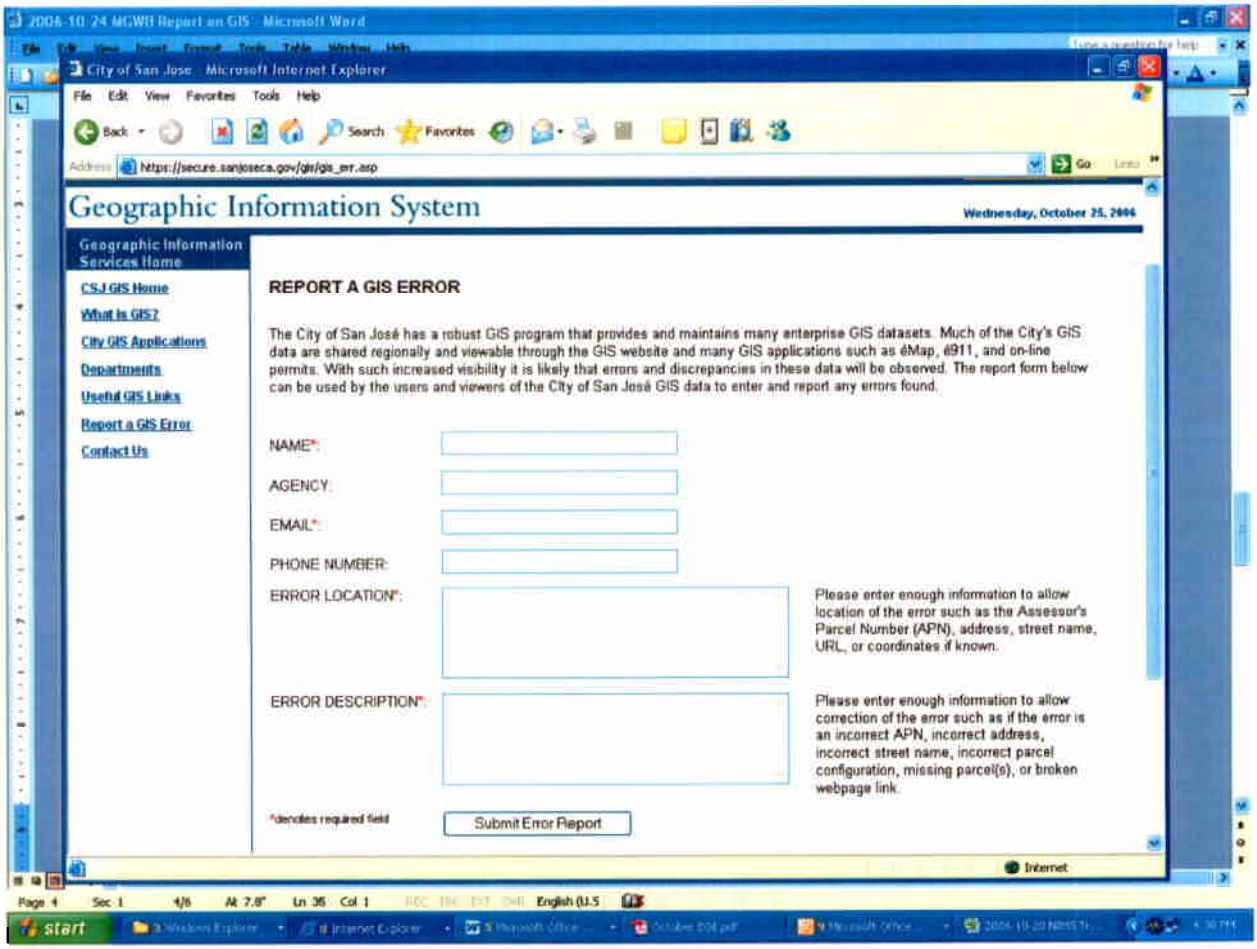

Figure 14: View of the GIS error reporting page on the internet

FUNDING

Historically, GIS efforts in the City of San Jose have been supported by special funding sources from programs that are receiving direct benefits from GIS work including Capital Funds, Development Fees, and Sewer Service Fees. The funding that is available is invested, almost entirely, in positions. Beyond funds for server maintenance and software licenses there is no ongoing GIS non-personal funding. If additional ongoing funds can be identified, the GIS program would benefit greatly from having a pool of non-personal funding that could be used to

research new technology, acquire new software and software upgrades, or allow the City to participate in county-wide initiatives (as orthophotos and contours). Each of these investments would have potential benefits for the community as well as for operational efficiency. There are also significant potential benefits to be derived from the marriage of GIS with new mobile technologies including WiFi.

The City's GIS staff receive numerous requests for products and services from other programs, Council Offices, Council Appointees, the Redevelopment Agency and from residents. These requests consume a significant amount of staff time for work that is usually unrelated to available funding sources. Residents may be charged a cost-based fee for maps as stipulated in the Fee Resolution. On occasion another program may supply a charge number for the staff time involved in providing GIS services, but more often the work is done without reimbursement for the cost. Maximum benefit from GIS is derived when data from a single GIS data source is shared with all programs for which the data is relevant. The shared use of GIS data maximizes efficiency by eliminating duplication of effort. Currently, however, many parts of the organization are directly benefiting from the work of Public Works and IT staff in maintaining the GIS base map, infrastructure layers, and system hardware without sharing in the cost of those endeavors.

In the coming months, staff will review GIS-related costs and services provided and explore ways to distribute the necessary costs of maintaining a robust and up-to-date GIS capacity. If an appropriate cost sharing package is identified and agreed upon with client departments, a revised funding package will be brought forward for Council consideration in the 2007-2008 budget process.

AWARDS

Intergraph's 2005 Geospatial Achievement Award – Government Solutions Category
Awarded at the Intergraph GeoSpatial World conference in San Francisco

Oracle Spatial's 2005 Integrated Enterprise Award for Excellence
Awarded at the conclusion of the Geospatial Information & Technology Association conference in Denver.